1997 LEONID SHOWER FROM SPACE

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Abstract. In November 1997, the Midcourse Space Experiment satellite (MSX) was deployed to observe the Leonid shower from space. The shower lived up to expectations, with abundant bright fireballs. Twenty-nine meteors were detected by a wide-angle, visible wavelength, camera near the limb of the Earth in a 48-minute interval, and three meteors by the narrow field camera. This amounts to a meteoroid influx of $5.5 \pm 0.6\ 10^{-5}$ km^{-2} hr^{-1} for masses > 0.3 gram. The limiting magnitude for limb observations of Leonid meteors was measured at $M_v = -1.5$ magn. The Leonid shower magnitude population index was 1.6 ± 0.2 down to $M_v = -7$ magn., with no sign of an upper mass cut-off.

Keywords: Flux, Leonids 1999, meteors, meteor shower, MSX, population index, space

1. Introduction

Space based observations of meteors are at a disadvantage in being further away from the meteors than ground-based observers and instrumentation being more expensive to operate, so less observing time

record of meteors near the slit of the spectrograph. Each image was integrated for 0.5 seconds, with alternating images for each camera every second.

The viewing geometry was chosen to have the spectrographs look to the nighttime limb of the Earth in fixed anti-Sun direction, with the slit parallel to the Earth's surface. Bright Leonid fireballs have the brightest point at about 95 km altitude, while fainter Leonids tend to peak near 100 km altitude. In order to increase our chances of detecting a persistent train and capture different parts of the meteor track, we covered the altitude range between 120 and 80 km in 10 mirror steps perpendicular to the Earth's surface, taking into account the curvature of the Earth. As a result, the cameras are oriented parallel to the Earth's limb and centered in a direction corresponding to 100-km altitude at the limb.

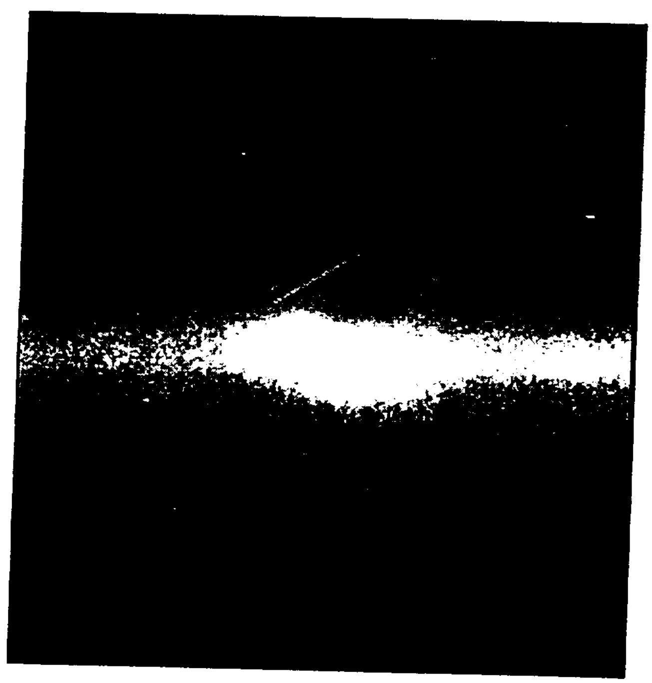

Figure 1 Leonid meteor ablating above the airglow layer in a UVISI Narrow Field UV and Visible Image.

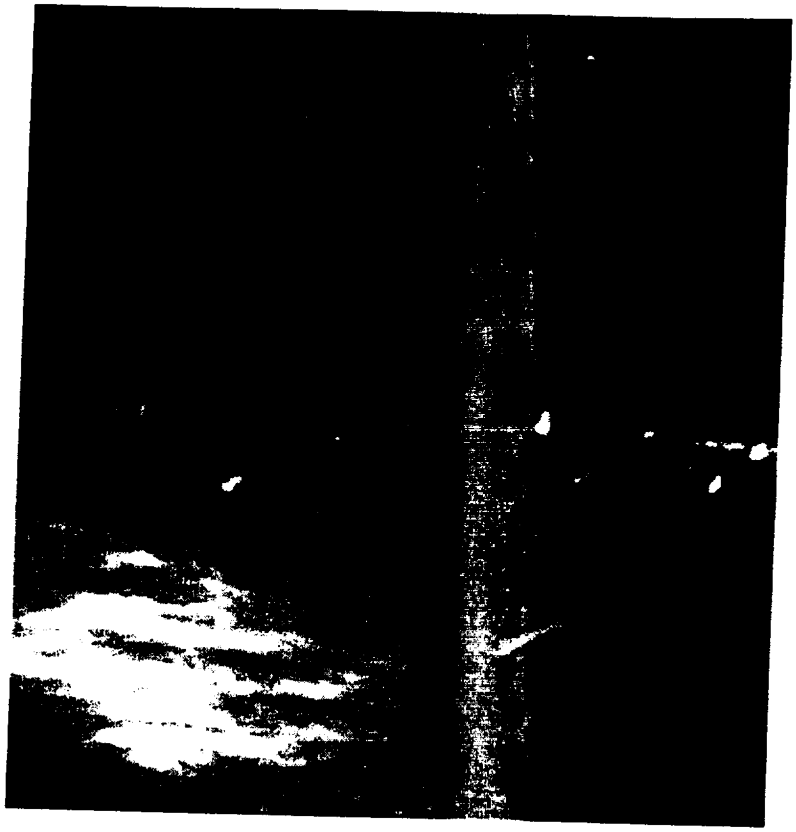

Figure 2a Composite of Leonid meteors in wide-angle camera. We chose the most striking star background and cloud pattern observed between 15:20 and 15:59 UT. Full Moon glare is visible on the clouds in the lower left of the image.

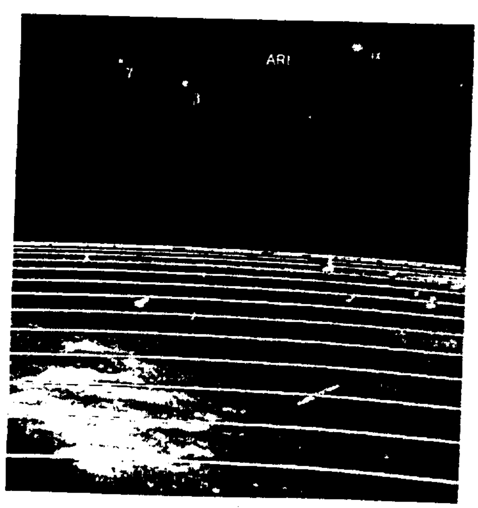

Figure 2b Equidistant lines from the satellite to a layer at altitude 100 km. Stars serve as magnitude calibration. Stars in the constellation of Aries are marked.

magnitudes in the range +0 to +5 magn. A general dominance of bright meteors was observed by forward meteor scatter radar (Foschini *et al.*, 1998). From ground-based video observations, Hawkes *et al.* (1998) found, s = 1.71 ± 0.07, which corresponds to r = 1.92 ± 0.13. Hence, we can confirm that the trend for meteor magnitudes between +0 and +5 continued until at least -7 magnitude, without any sign of an upper mass cut-off.

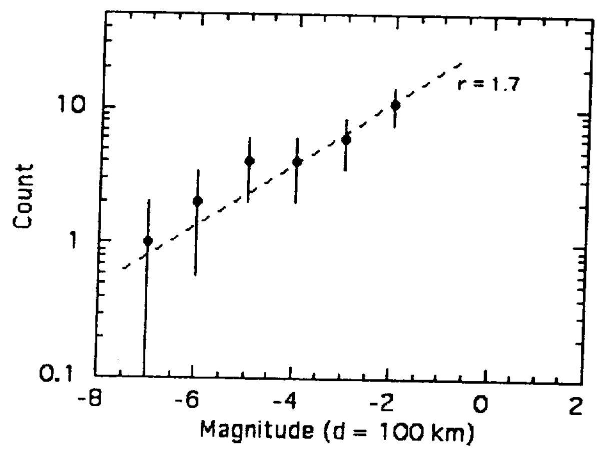

Figure 3 Meteor count in intervals of absolute magnitude distribution.

With this information, it is possible to calculate the influx of meteoroids of magnitudes less than −1.5, or masses larger than about 0.3 gram (Jacchia *et al.*, 1967). For, r = 1.7, we count 40 meteors below the integral dashed line in Figure 1. The observing interval covers a period of 48 minutes. The wide field imagers were recording data during about 40% of that time. The effective surface area perpendicular to the shower is about 1.1 x 10^6 km^2. The radiant of the shower is about 36 degrees out of the zenith on average over the spatial and temporal interval. Hence, the influx of meteoroids > 0.2 gram (< −1.5 magn.) was 5.5 ± 0.9 x 10^{-5} km^{-2} hr^{-1} at the peak of the 1997 Leonid shower between 15:12 and 15:59 UT. Arlt and Brown (1998) reported ZHR = 96 ± 13 at the peak at 12:15 UT, which translates to about 1–5 x 10^{-2} Leonids km^{-2} hr^{-1} of limiting absolute magnitude +6.5 and brighter. Extrapolation of our magnitude distribution, r = 1.7, gives 1.6 ±0.3 x 10^{-2} km^{-2} hr^{-1} at 15.6 UT, in general agreement with the results reported by Arlt and Brown (1998).